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Progress in the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States

Report of the Secretary-General

Addendum

Freshwater in small island developing States*

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I. Introduction

1. Small islands have limited options when developing their freshwater resources. The relatively short length of surface water circulation in small islands limits the methods available to utilize them. Groundwater occurrences are highly dependent on regular recharge events. The geophysical settings of many small island developing States leave them vulnerable not only to extreme climatological and seismic events but more critically to periods of low recharge and adverse environmental impacts, including pollution, saline intrusion, soil erosion and mass wasting. On volcanic piles dominated by rapid baseflow recession and groundwater fracture flow, on atoll islands and on coastal aquifers with thin freshwater "lenses" floating above seawater, limits in terms of water quantity and quality can be reached very quickly in periods of low recharge.

2. The relative fragility of the hydrological cycles on small island developing States means that the evaluation, planning and development of freshwater resources has to be approached with special care within the hydro-environmental limits. The prevention of saline intrusion is a case in point: small changes in freshwater table elevations from excessive abstraction can lead to wholesale upcoming of saline water into coastal aquifers and freshwater lenses, effectively removing large sections of aquifers from the available water resource base.

3. The issue of water resources in small island developing States involves many of the same problems that face developing countries in general, including inadequate management frameworks and resources, both human and financial. However, other issues unique to small island developing States, notably their highly constrained freshwater resource base and the patterns of development on limited habitable land, pose particular challenges for freshwater resources management.

II. Issues facing small island developing States in sustainable management and use of freshwater resources

The knowledge base

4. Obtaining detailed knowledge of the freshwater resource base in many small island developing States is hampered not only by finance and technical capacity but also by the technically challenging physical settings, which make baseline research and investigation extremely difficult. Those conditions are in many ways unique to small island developing States, particularly in the case of groundwater resources. In the limestone and volcanic terrains of small island developing States, groundwater may only be available in fracture systems that are difficult to exploit and whose reliability is difficult to assess. Even conducting surface geophysical surveys and drilling is demanding, and the costs and logistics of thorough groundwater exploration and development are very high and an obstacle to development.

Hydro-meteorological uncertainties

5. The dependence on regular recharge events to maintain surface-water flows and the integrity of aquifer replenishment implies that sustainable operational management of small island developing States' freshwater resources requires constant supervision, sometimes on a daily basis, such as in times of low rainfall or in the case of freshwater lens exploitation. Although the range of meteorological variability can be expected to increase as climate changes, the imperative is not to understand climate change as such but rather to find operational methods to manage freshwater resources under conditions of increased variability and range. However, the financial and human resource constraints in many small island developing States often preclude data acquisition and progressive approaches to resource conservation and management. Indeed, routine monitoring of catchment and aquifer status is the exception rather than the rule in many small island developing States, where such capacity constraints are binding.

Limited water storage capacity

6. Despite the relatively high rainfall that most of them receive, many small island developing States often have few or no permanent streams, lakes or springs. They also have limited capacity to store water for use during the dry season. In fact, building reservoirs in small island developing States, even when land is available, is fraught with complex geotechnical and hydraulic problems. In addition, the combination of high rainfall intensities, steep topography and short river channels requires structures and spillways to accommodate flash floods, and easily erodible soils can cause rapid siltation of reservoirs, further decreasing their live storage capacity. As a result, many small island developing States depend heavily on regularly recharged groundwater resources. On atolls and in coastal aquifers, such resources often exist in the form of freshwater lenses that effectively sit on higher density saline water. Such lenses have to be carefully skimmed with low-yielding pumps, taking account of tidal effects. Water withdrawals

at rates that exceed recharge can result in upcoming of the underlying saline water, effectively destroying the freshwater lens. In the case of groundwater flow through massive fractured systems, horizontal galleries are often used as collectors but they need to intersect a certain number of productive fractures.

Pollution

7. Pollution of surface and groundwater by domestic sewage and industrial effluents is rapidly degrading the water resource base of many small island developing States. Not only is regulation of such waste disposal difficult to achieve but small island developing States also face particular problems in installing sewage and sewage treatment infrastructure. Steep, unstable terrain on volcanic islands makes the construction and maintenance of sewage mains difficult, and the low topography of atoll islands makes installation of conventional gravity systems almost impossible. Many rural areas have no choice but to resort to pit latrines. In addition, small island developing States are especially vulnerable to the effects of natural disasters (e.g., cyclones, earthquakes), which can damage their sewer and related water systems, thereby polluting both surface and groundwater resources.

8. All countries experience problems in disposing solid wastes. That problem is exacerbated in small island developing States by a limited spatial area and vulnerable groundwater resources, making the option of landfill disposal unsustainable over the long term. Small island developing States also often have high population densities located on the less steeply sloping lands along their coastlines, which increases the susceptibility of coastal water to pollution. Waste minimization and recycling can offer some scope for reducing groundwater pollution by reducing the dependence on landfills.

9. The disposal of partially treated or untreated domestic and industrial effluents in the sea has been a standard practice for many small island developing States. When biological waste predominated, such disposal did not pose too many problems as long as the discharge outlets were correctly designed and maintained. However, indiscriminate disposal into near-shore environments with poor flushing to the open sea has reduced coastal water quality, particularly near large coastal lagoon settlements. As chemical and organic pollutants become more pervasive, the adverse impact on marine environments is increasing, and long-term accumulation in marine ecosystems is threatening biodiversity and the local fishing industry upon which many small island developing States are highly dependent.

Financing and regulating water supply and sanitation utilities

10. Achieving economies of scale in providing water supply and sanitation services is difficult under the physical and socio-economic conditions of many small island developing States. The financing and management of water supply and sanitation utilities to service growing populations and tourist facilities is difficult when concentrations of population and the sources of water are small and widely dispersed. For instance, ring mains along accessible coastal zones may be the only options in many cases, but they must have long stretches and would be prohibitively expensive to install and maintain. Equally, the procurement cost of water-related equipment is high, given high transport costs and little chance to negotiate bulk discounts. For moderately populated islands, the overheads associated with running water services are particularly high, and the consumer base is often so poor that setting tariffs at levels that would recover the cost of the water services can prove difficult.

11. The regulation of water and sewage utilities to ensure adequate conformity to public health guidelines and the achievement of financial sustainability is difficult. The scope for setting realistic performance targets and providing appropriate incentives is extremely limited when the financial and operational base is so small.

Demands of irrigated agriculture

12. Irrigated agriculture is very important for many small island developing States. With transport costs high, pressure to grow market crops raises water demands for irrigation. Bulk water demands are made on an already limited resource base, and often compete with demand for raw water for potable supplies. The expansion of irrigated agriculture is already polluting local surface and groundwater sources, as fertilizers and pesticides are applied in increasing amounts.

Coping with the demands of tourism and industrial development

13. High water consumption by tourists and consequent production of waste water, particularly in coastal settings, poses problems for liquid and solid waste disposal on coastal aquifers or atoll freshwater lenses. Indeed, the marketing of small island developing States as "sun, sea and sand" paradises has resulted in many hotels being built on or near beach areas, thereby concentrating waste-producing establishments near coastal waters. Industrial activities are also located in the coastal centres. On account of weak or absent standards and/or waste-disposal facilities, the environmentally sustainable disposal or treatment of wastes,

particularly liquid wastes, has in several cases been left to the operators of hotel establishments and industrial facilities, often with little success. In view of water scarcity there is pressure to import costly energy-intensive desalination plants, notably those using reverse osmosis, to supply hotels and processing industries, such as breweries and fish-processing plants.

Implementation of integrated management and environmental protection

14. The difficulty of implementing drainage basin controls and environmental protection, coupled with economic development of tourism, agriculture and industry can severely reduce the spatial extent of drainage basins that furnish freshwater supplies. In the Caribbean, for example, the expansion of banana cultivation has reduced protected catchment areas. Many islands that derive their water from filtered intakes in the upper catchments of radial streams have major erosion problems in catchment areas, mainly because of ad hoc land development and poorly maintained roads. Equally, municipal well fields are compromised by pit-latrine development in localized borehole catchments.

15. To date, many small island developing States management and regulatory regimes have not adequately considered the dynamics and integrated nature required to address island hydro-systems. The sectoral approach to management has not proven adequate in addressing a variety of vital development and environmental issues, particularly public health and environmental sanitation. It also does not adequately consider other public or private sector involvement, thereby minimizing the role of communities in the decision-making process.

Human resources needs

16. For many small island developing States, the needed technical and scientific data are either missing or inadequate because of shortages of expertise to collect and analyse them. In fact, the population of many small island developing States is too small to justify the establishment of sufficiently advanced technical institutions, resulting in a shortage of trained technical and other needed expertise. Thus, water projects are often implemented without accurate knowledge of the availability and sustainability of water resource systems.

Public awareness

17. There is much evidence that indicates that the level of awareness about water resource issues is very low in small island developing States. Demand management is sometimes rendered ineffectual when cultural expectations and habitual practices linked to water prove difficult to change in times of increased demand and severe patterns of drought. However, the relatively small size and spatial concentration of the populations in many small island developing States can make the task of public education and outreach more manageable. The potential benefit of such public awareness programmes can be very high.

III. Regional cooperation in sustainable management and use of freshwater resources

18. The benefits of pooling experience and expertise in freshwater resource management are well recognized. Inter-island associations have been set up to promote such sharing of experiences and to provide a degree of leverage in procuring equipment and services. Such associations can involve not only island-to-island links but also triangular links with developed countries through bilateral and multilateral assistance.

19. A regional water supply and sanitation project in the Caribbean was started in 1979 and operated in the region for more than 10 years. The presence of the project in the islands for a prolonged period, and the exploration, assessment and planning of water resources that the project carried out attracted a great deal of external support for improving water supply in all the participating countries. At the end of the regional project, part of its equipment and library was transferred to the Caribbean Environment Health Institute and part to the Caribbean Institute of Meteorology and Hydrology, which continue together to carry out a number of the activities of the regional project. A twin project in the Pacific was subsequently initiated in 1986, and continues under the auspices of the South Pacific Applied Geoscience Commission. The project has assisted 15 island countries of the South Pacific, and has dealt with many of the above-mentioned problems. It has administered and technically supported 15 country projects in six countries.

IV. Activities of the United Nations system in support of small island developing States

20. To continue providing assistance to the developing countries, the Economic and Social Commission for Asia and the Pacific published technical guidelines in support of

national efforts in (a) sustainable development of water resources (guidelines on water and sustainable development: principles and policy options, issued in August 1997), and (b) water-related disaster reduction and management (guidelines and a manual on land-use planning and practices in watershed management and disaster reduction, issued in October 1997). The guidelines were subsequently distributed to member countries, including small island developing States.

21. The post-United Nations Conference on Environment and Development policy of the United Nations Environment Programme (UNEP) is consistent with the urgent need to take action to support the sustainable development of small island developing States, particularly for the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. Through its Industry and Environment Programme Activity Centre, UNEP has provided assistance for the environmentally sustainable management of hotels. Through its International Environment Technology Centre, UNEP is cooperating in regional exercises, including in small island developing States, to prepare regional source books on technologies for augmenting water supplies. The source books represent an important contribution to ongoing efforts to address water scarcity, especially household water security.

22. The United Nations Development Programme (UNDP), with the technical assistance of the United Nations Secretariat, has initiated and implemented regional projects for water in the Pacific and Caribbean islands. UNDP has also helped Cape Verde to prepare a national water master plan and assisted Comoros with the delicate construction and operation of wells tapping coastal aquifers for drinking water supply.

23. The World Hydrological Cycle Observing System (WHYCOS) developed by the World Meteorological Organization (WMO), with the support of the World Bank, the European Commission, France and other donors, was initially established to install a global network of about 1,000 stations on major rivers to monitor discharge and water quality, and to transmit data in near real time via satellites to global, regional and national centres. The process of establishing a WHYCOS subsystem for the Caribbean region is currently under way, and is receiving wide support from the countries in the region, which are fully aware that effective regional cooperation is needed at a time when many are experiencing dramatic reductions in both basic and specialized observation networks. Plans have also been initiated to explore the establishment of a WHYCOS subsystem in the Pacific region, where again the emphasis will be on island States. Enhanced monitoring and information exchange is critical in that region, particularly in view of the recent disastrous impacts of El Niño on several small island developing States.

24. The cross-cutting character of disaster reduction, as defined in the International Decade for Natural Disaster Reduction (IDNDR), provides an effective link between various strategy objectives of sustainable development, such as freshwater resources, taking into account the particular needs of small island developing States. With regard to water, disaster reduction activities can contribute to the sustainable development of small island developing States through, *inter alia*, an accurate assessment of available freshwater resources and of the natural-hazard-induced risk for water infrastructure. The International Framework of Action for IDNDR is actively involved in the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. The IDNDR secretariat has also promoted projects for research, hazard assessment and early warning specifically aimed towards the needs of small island developing States.

25. The Global Environment Facility (GEF) is currently supporting projects related to sustainable management and the use of large marine ecosystems. Within that context, UNEP, UNDP and the World Bank are collaborating in assisting small island developing States within the GEF framework, including efforts at the regional level to facilitate the environmentally sustainable use of freshwater and coastal waters and their living resources. The World Bank is also financing a regional solid waste management programme in the Caribbean to mitigate groundwater pollution, among other environmental impacts. In addition, the Asian Development Bank is financing the development of water utilities in the Federated States of Micronesia.

V. Recommendations for future action in the area of freshwater resources

A. Enhancing integrated planning and management

26. Even more than non-insular countries, small island developing States need an integrated approach to water resources management that includes strengthening institutions that can fundamentally affect their environmentally sustainable management and use of water resources. Such an approach includes the formulation/revision of national policy and strategies, as well as action plans involving various interested actors: local authorities,

non-governmental organizations, civil society, the private sector and users of water resources. Cross-sectoral collaboration between land and water planning should be actively promoted, and the effectiveness of water and environmental agencies to monitor and enforce good spatial planning practice in fragile upland and coastal zones needs to be enhanced. In addition, there is a need to consider the adoption and application of environmental risk assessments, remote sensing for land use and micro-zoning.

B. Promoting technical cooperation among small island developing States

27. Small island developing States often need island-specific or regional studies to identify and assess their water resources, and to formulate and implement effective development and management programmes. To that end, some small island developing States in different regions have organizations that can share their technical expertise and experience with other small island developing States. Establishment of relevant institutions, where needed, is one means of facilitating such exchange; one existing example is the Pacific Water and Waste Association. It would also be helpful to encourage linkages between small island developing States and the bigger archipelagic countries that have development programmes for their outer islands.

C. Promoting water resources assessments

28. Governments are urged to take measures aimed at reversing the growing decline in national hydrological networks. They should support initiatives for the maintenance and improvement of hydrological and relevant meteorological observation programmes, such as WHYCOS, in order to enhance the provision of comprehensive data and information for applications, user services and for research; that is especially crucial in many developing countries, where international assistance needs to be enhanced. Efforts should also be directed at facilitating international exchange of hydrological and related data and products, and strengthening national and regional capacities through training and technology transfer, so that global studies of freshwater resources and climate change and variability can be conducted and useful results produced for the benefit of people living on small islands.

D. Promoting policies encouraging efficient management and use of existing water resources

29. Further efforts are required to promote demand management, efficiency of water services and protection of water sources. Demand management and leak detection can help to conserve the existing resource base. Proactive programmes of waste management and minimization can help to protect the resource base but must be clearly linked to land management policies if they are to be effective.

E. Promotion of techniques and methodologies appropriate for small island developing States

30. Technologies more appropriate for small island developing States, such as rainwater harvesters, groundwater collectors through horizontal galleries, radially drained wells to skim freshwater lenses and low-yielding solar pumps, need to be promoted to avoid last-resort solutions, such as desalination. Further identification and application of cleaner production methodologies, relating to the specific development and resource needs of small island developing States, should also be priority activities. They should include cleaner practices and efficient use of water resources in all industries, particularly the growing industrial and agricultural sectors, hotels and tourism facilities.

31. The unique characteristics of small island developing States calls for action to develop self-sufficient facilities for handling solid waste, sewage and waste water, and facilities for preventing groundwater contamination.

F. The island systems management approach

32. The diminutive size of small islands means that sustainable socio-economic development and the needed natural resource base, including water resources, are interdependent. Thus, consistent with the thrust of the Programme of Action, the management and use of freshwater, coastal and marine resources should be undertaken within an institutional framework that takes into account linkages with the sources of potential impacts on those resources.